

(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 904 928 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:  
31.03.1999 Bulletin 1999/13

(51) Int. Cl.<sup>6</sup>: B29C 70/20, E04C 5/07

(21) Application number: 97390007.9

(22) Date of filing: 26.09.1997

(84) Designated Contracting States:  
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC  
NL PT SE

(71) Applicant: Cho, Moon Soo  
Seodaemoon-Gu, Seoul (KR)

(72) Inventors:  
• Cho, Yong Jun  
Milyang-Si, Kyung Nam (KR)  
• Chung, Sam Tae  
Milyang-Si, Kyung Nam (KR)

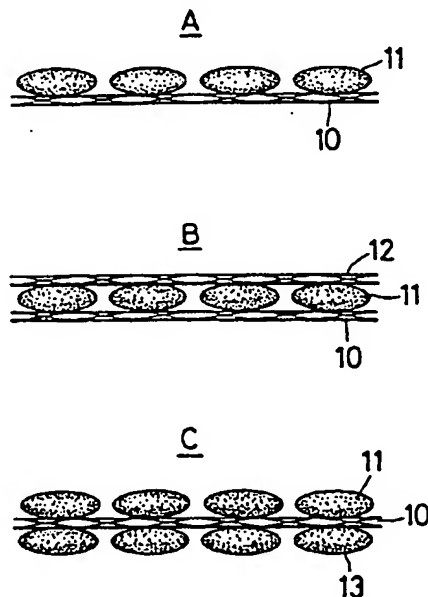
• Cho, Se Hyun  
Milyang-Si, Kyung Nam (KR)  
• Jeong, Il Soo  
Changwon-Si, Kyung Nam (KR)

(74) Representative:  
Morelle, Guy Georges Alain  
Cabinet Morelle & Bardou,  
5, Bd de la Méditerranée,  
B.P. 4127  
31030 Toulouse Cedex 4 (FR)

(54) Manufacturing method of reinforced fiber sheet useful for repairing / reinforcing concrete structure

(57) For obtaining the reinforced fiber sheet usable for repairing/reinforcing concrete structure having desirable characteristics such as superior durability, superior strength and anti-vibration, simultaneously with obtainable for the abbreviation of the reinforcing works, easy treatments, uniform quality with concrete structure, this invention provides the manufacturing method of the reinforced fiber sheet comprising arranging reinforcing fiber (11) on one surface of a support (10) that is of net shaped fabric infiltrated with thermoplastic resin and adjusting it flat and uniformly and then heating and pressurizing.

FIG. 3



EP 0 904 928 A1

## Description

### PRIOR ART AND TECHNICAL FIELD

[0001] This invention relates to the manufacturing method of reinforced fiber sheet usable for repairing/reinforcing the concrete structure such as ferro-concrete bridge, elevated express highway, tunnel, and building or so like, and specially to the manufacturing method of reinforced fiber sheet having superior durability, superior strength and anti-vibration, simultaneously with obtaining the many advantages when repairing or reinforcing, such as abbreviation of processes and easy treatments, maintenance of uniformed quality with the concrete structure and increase of strength.

[0002] As reported, even if the duration of concrete structure is recognized as of semi-permanent, but after completion of construction its side effects have sometimes been reported, thus its repair or reinforcement comes into important things.

[0003] The above-mentioned unsatisfactory phenomenon in the concrete structure is reported to be mainly due to overload or accumulation of overload due to increase of traffic amount, overloaded vehicles or more fast train and vibrations on the concrete structure, together with neutralization of the material as used, rust of the reinforced iron, break-up due to expansion of iron, peeling-off phenomenon on the surface, structural problems, usage of low class concrete or material, low qualified construction technique, chemical reaction with the salt in the air or with the contaminated materials and so like.

[0004] When the problems is found on the concrete structure after its completion, there are three methods to repair/reinforce it, respectively, steel panel reinforcing method, special fiber reinforcing method and the combined method of said both methods.

[0005] In the above three methods, the reinforcing method utilizing special fiber material is illustrated in the Fig 1 (A) and (B), in which (A) shows the structure that the anchor plate(2) is positioned on the concrete lump(1) and fastened with bolt(3), and reinforced fiber sheet(4) is attached to the side and bottom surface of the concrete lump(1) and then fastened by angle(5), whereas (B) shows the structure the reinforced fiber sheet(4) is attached to the side and bottom surfaces of the concrete lump(1) except the upper surface and then its top portion is fastened with bolt(6).

[0006] The reinforced fiber sheet used in the above example is that manufactured by applying the resin containing neither hardner(b) nor the adhesive on the one or both side of the supporter(a) which is usually made of film and so like, arranging the reinforcing fiber(c) having superior strength on it and then pressuring them, which is shown in Fig 2.

[0007] The reinforced sheet obtained as above is used for reinforcing the concrete structure by attaching it to

concrete structure with the usage of resin which can be readily treated with operator.

[0008] When repairing/reinforcing the concrete structure, the resin used for attaching the reinforced fiber sheet to the structure in the working place is not the matrix resin containing the hardening accelerator(A type) for preserving the reinforcing resin in one direction, but the resin hardening in the normal temperature(B type) which is attached in the form of solid and then used when repairing.

[0009] When repairing/reinforcing, the used resin harden in the normal temperature(B type) is required to be in combination with the reinforced fiber sheet.

[0010] For that reason, in order to attain the reciprocal combination, many scrubbing process are required, but because of work life of matrix resin in the normal temperature, easy work and treatment can not be obtained so that it is still unsatisfactory.

[0011] Here, working life indicates interval from the time for the hardener to be input into resin to the time for the viscosity degree to be risen so as not to use.

[0012] At all events, insufficiency of scrubbing work results in partial infiltration, thus impossible to obtain the desired strength.

[0013] So to speak, the difficulty to combine the resin in normal temperature with the reinforced fiber sheet incurs peeling-off phenomenon so that desirable strength cannot be obtained and its process management is difficult.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig 1 is the exemplary view showing the methods to repair/reinforce the concrete structure to be repaired or reinforced utilizing the steel panel, reinforced fiber or carbon fiber.

Fig 2 is the section view of conventional reinforced fiber sheet used in repairing/reinforcing the concrete structure, and in which

(A) is the view showing the one sided supporter  
(B) is the view showing the both sided supporter

Fig 3 is the section view of the reinforced fiber sheet for repairing/reinforcing the concrete structure in accordance with this invention, in which

(A) is the view showing one sided supporter  
(B) is the view showing both sided supporter  
(C) is the view showing both sided reinforcing fiber

Fig 4 (A), (B) and (C) is the schematic view briefly showing the devices for manufacturing the rein-

forced fiber sheet shown in Fig 3 (A), (B) and (C).

\* Numeral description of the drawings

[0015]

10,12- reinforcing fiber supporter

11,13-reinforcing fiber

#### DETAILED DESCRIPTION OF THE INVENTION

[0016] Accordingly, one object of this invention is to provide the reinforced fiber sheet for repairing/reinforcing the concrete structure, having the many desirable characteristics such as superior durability, superior strength and anti-vibration, simultaneously with obtainable for the abbreviation of the reinforcing works, easy treatments, uniformed quality with concrete structure.

[0017] This invention provides the reinforced fiber sheet for repairing/ reinforcing the concrete structure, in which the reinforcing fiber having superior strength has been arranged in one direction on one surface of the supporter that is of net-shaped fabric infiltrated with thermoplastic resin and then dried or net shaped fabric made of thermoplastic resin, and then after being adjusted flat and then together heated and pressurized by means of pressure roller.

[0018] Further, this invention provides the reinforced fiber sheet for repairing/ reinforcing the concrete structure, in which the reinforcing fiber having superior strength has arranged on one surface of the lower supporter and then on the reinforcing fiber, upper supporter has arranged on it, the supporter of which is net-shaped fabric infiltrated with thermoplastic resin and dried or net shaped fabric made of thermoplastic resin, and then together heated and pressurized by means of heater and pressure roll.

[0019] This invention provides the reinforced fiber sheet for repairing/ reinforcing the concrete structure, in which the reinforcing fiber having superior strength has arranged on both side of the supporter that is of net-shaped fabric infiltrated with thermoplastic resin and then dried or net shaped fabric made of thermoplastic resin, and then together heated, and thereafter pressurized.

[0020] The more detailed description of this invention will be hereinafter explained in accompanying with the Fig 3.

[0021] Fig 3 (A) is the reinforced fiber sheet in which the reinforcing fiber(11) is arranged on the reinforcing fiber supporter(10) infiltrated with thermoplastic resin and dried, and then pressurized.

[0022] The above reinforcing supporter(10) is made of organic fiber such as carbon fiber, glass fiber, cabular fiber and aramyd fiber or the thermoplastic fiber be infiltrated with thermoplastic resin and then dried, or the thermoplastic net shaped fabric, the net shaped fabric have two or three axis direction.

[0023] For making the reinforced fiber sheet, as shown in the Fig 4, the rolled reinforcing fiber supporter(10) and rolled several threaded reinforcing fiber(11) are simultaneously unraveled, and together pass through the pressure roll (14), where the reinforcing fiber(11) is arranged in the one direction and adjusted flat, and then it entered into heater radiating the necessary heat and become attached each other, and thereafter finally pass throughout the pressure roll(16) for finished product.

[0024] After completion of precesses, the surface of finished product is covered with the paper for protecting the surface be attached to the concrete structure from the outside materials.

[0025] Fig 3 (B) is the another embodiment of this invention in accordance with this invention, in which for making the reinforced fiber sheet the rolled upper and lower reinforcing fiber supporter(10,12) and several threaded reinforcing fiber (11) are unraveled simultaneously and together passed through the pressure roll (14), at the place where the reinforcing fiber(11) is arranged in the one direction and adjusted uniformly and plat, and then pass throughout the heater(15) for attachment of them each other and next to throughout the pressure roll (16) for finished product. After completion of precesses, the surface of finished product is covered with the paper for protecting the surface be attached to the concrete structure from the outside materials.

[0026] Fig 3 (C) is the another embodiment of this invention in accordance with this invention, in which the rolled reinforcing fiber supporter(10) and rolled upper and lower several threaded reinforcing fiber(11) are unraveled simultaneously and passed through the pressure roll(14), at the place where reinforcing fiber(11) is arranged in the one direction and adjusted uniformly and plat, and then it pass through the heater(15) and pressure roll(16) in order for finished product.

[0027] After the completion of process, cover sheet for protecting the surface is added to the reinforced fiber supporter(10) for protecting the surface to be attached to the concrete structure from the other materials.

[0028] In the above all the embodiments, the inner state of the supporter(10,12) and reinforcing fiber(11,13) remains as a state of non-hard and non-adhesive so that fluid resin for repairing/reinforcing can be readily and quietly infiltrated into between the threads of the reinforcing fiber, thus possible to obtain the desired strength.

[0029] The oval figure of the reinforcing fiber(11,13) in the Fig 3 is to explain the state of the the reinforcing fiber(11,13) when pressurized.

[0030] For repairing or reinforcing, fluid resin harden in the normal temperature is added to the surface of concrete structure and then the sheet is attached on it, and thereafter the scrubbing work follows. At that time, the wave of the reinforcing fiber is required to be transverse to the concrete structure. Further fluid resin harden in

the normal temperature is once again added and the last scrubbing is performed.

[0031] As explained above, this invention does not adopt the the both usage of previous infiltrated resin(type A) and fluid resin harden in the normal temperature(type B) on the reinforced fiber sheet, instead use only fluid resin (type B) harden in the normal temperature.

[0032] The fluid resin harden in the normal temperature used as above can be infiltrated quietly into the reinforcing fiber supporter(10) or reinforcing fiber(11) and then attribute to attach it to the surface of concrete structure.

[0033] The reinforced fiber sheet provided in accordance with this invention is used by adding the heat to the its surface, thus flexible and dried . Therefore, many advantages such as easy treatment, easy operation, works or so like can be obtained rather than the conventional sheet which is adhered by the usage of the thermosetting resin. In addition, owing to its flexibility, the attachment of it to the surface of concrete structure can be also easy.

[0034] And, the necessary infiltration condition required for the reinforcing fiber supporter to becomehesive is completely overcome. Furthermore, after repairing works, peeling-off phenomenon is restricted to the degree of maximum due to the superior attachment to the concrete structure by the usage of fluid resin hardening in the normal temperature, thus possible obtain the concrete reinforcing structure, together with abbreviation of work time and high degree of accuracy.

#### Claims

1. The manufacturing method of reinforced fiber sheet comprising of arranging reinforcing fiber(11) on the one surface of the supporter that is of net shaped fabric infiltrated with thermoplastic resin and adjusting it flat and uniformly and then heating and pressurizing.
2. The manufacturing method of reinforced fiber sheet in accordance with with claim 1, characterized in that said reinforcing fiber supporter(10) having superior durability is made of organic fiber such as carbon fiber, glass fiber, cabular fiber and aramyd fiber or the thermoplastic fiber be infiltrated with thermoplastic resin and then dried, or the thermoplastic net shaped fabric, the net shaped fabric of which have two or three axis direction.
3. The manufacturing method of reinforced fiber sheet in accordance with with claim 1, characterized in that the second reinforcing fiber supporter is arranged on said reinforcing fiber and then together heated and pressurized.
4. The manufacturing method of reinforced fiber sheet

in accordance with with claim 1, characterized in that the second reinforcing fiber is arranged on the other side of supporter in one derection and adjusted flat and uniformly , and then together heated and pressurized.

FIG. 1

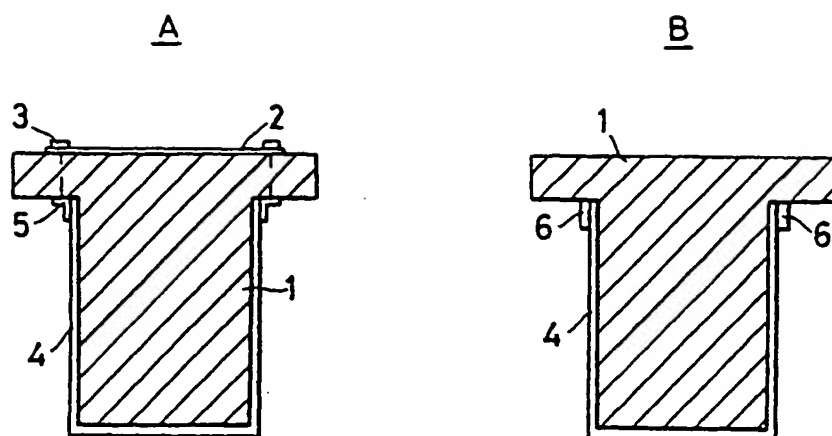


FIG. 2

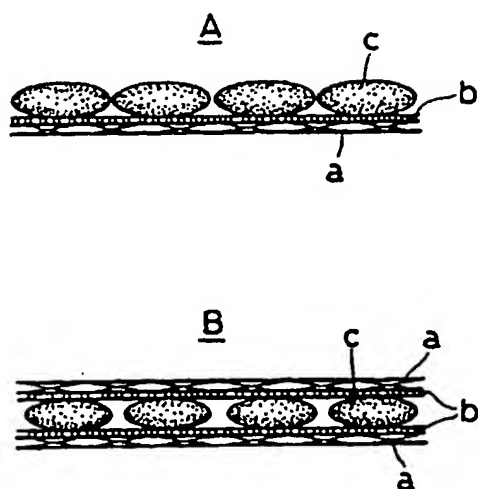


FIG. 3

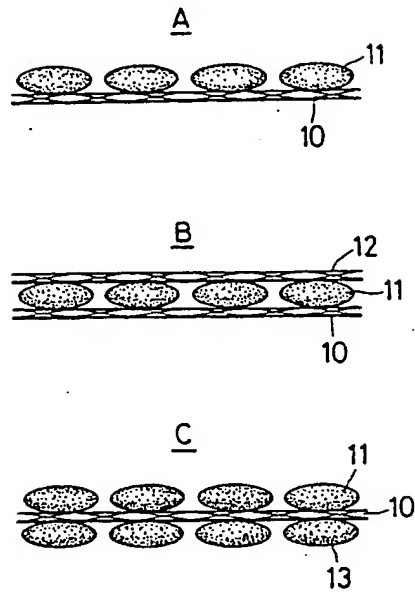
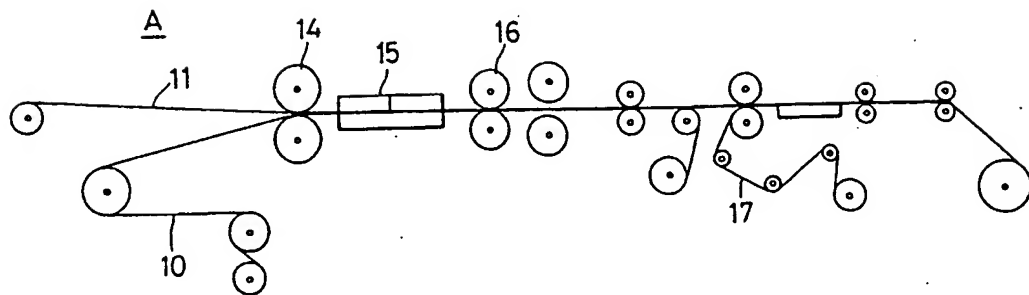
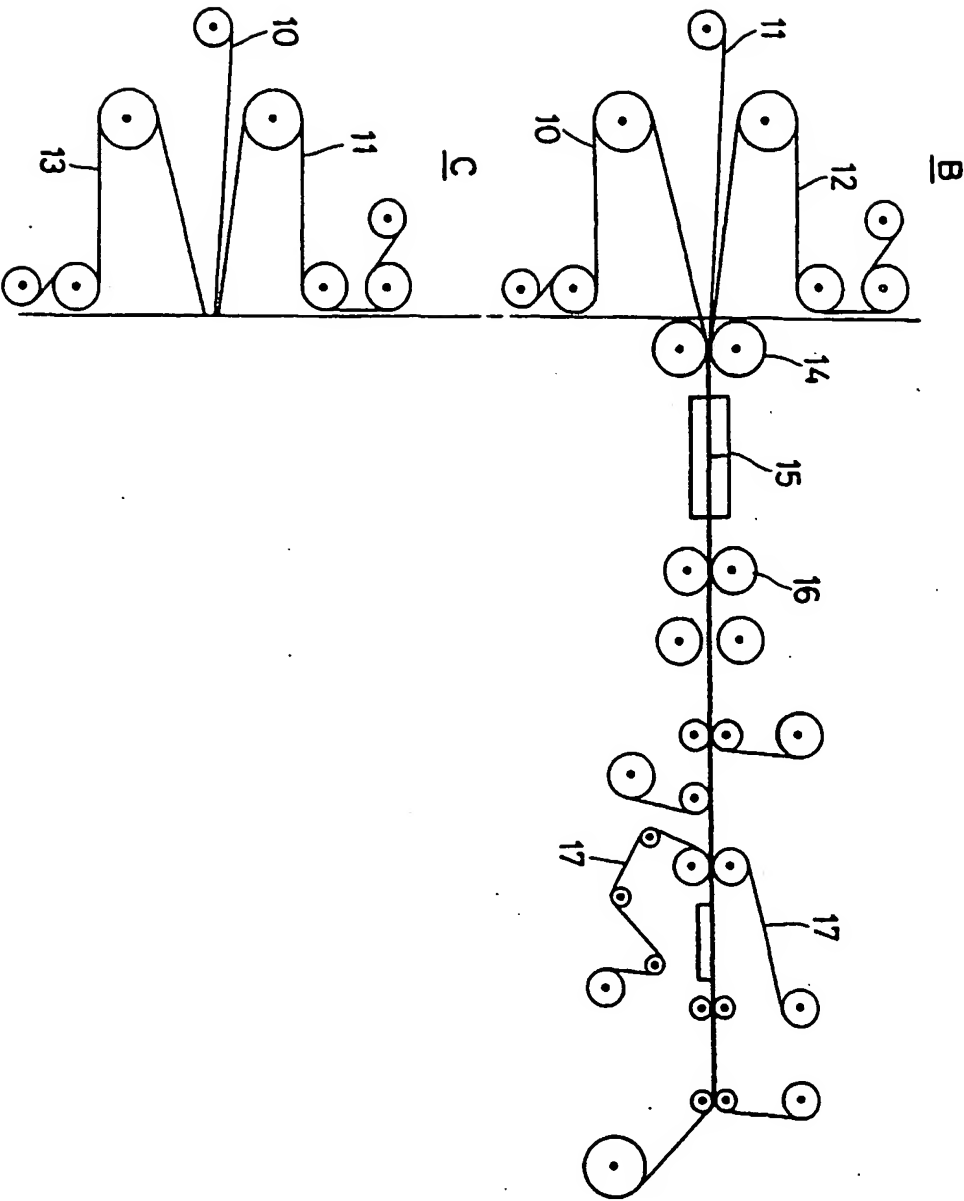


FIG. 4







European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number  
EP 97 39 0007

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	FR 1 167 764 A (AMBRUS, TIBOR) 28 November 1958 * page 3, column 2, last paragraph - page 4, column 1, paragraph 1 * * page 2, column 2, last paragraph - page 3, column 1, paragraph 1 *	1-4	B29C70/20 E04C5/07
A	EP 0 441 519 A (TONEN CORP) * claims 1-7,10-12; figures *	1-4	
A	EP 0 598 591 A (TONEN CORP) * claims; figures 1-4 *	1-4	
A	EP 0 500 990 A (DU PONT) * claims 1,8 *	1-4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B29C E04C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13 February 1998	Examiner Van Wallene, A
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			

EPO FORM 1503 (3.82) (P04C01)



**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 97 39 0007

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13-02-1998

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 1167764 A	28-11-58	DE 1090166 B GB 845744 A	
EP 0441519 A	14-08-91	CA 2071097 A JP 3222734 A JP 3224901 A JP 3292110 A JP 3292111 A JP 3293408 A JP 4149366 A US 5326630 A US 5308430 A DE 69122976 D DE 69122976 T EP 0723855 A KR 9709566 B	13-12-93 01-10-91 03-10-91 24-12-91 24-12-91 25-12-91 22-05-92 05-07-94 03-05-94 12-12-96 05-06-97 31-07-96 14-06-97
EP 0598591 A	25-05-94	JP 6182766 A CA 2103220 A JP 6206272 A	05-07-94 18-05-94 26-07-94
EP 0500990 A	02-09-92	US 5085928 A AU 632975 B AU 7139291 A	04-02-92 14-01-93 03-09-92

EPO FORM P0439

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82